



On the time spent preparing grant proposals: an observational study of Australian researchers

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On the time spent preparing grant proposals 1

Title

On the time spent preparing grant proposals: an observational study of Australian researchers

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Contributors

AGB, PC and NG conceived and designed the study, and analysed the data. All authors interpreted the data, drafted the article or revised it critically for important intellectual content and approved the version to be published. AGB is the study chief investigator and acts as the guarantor.

Competing interests

DLH salary is supported from NHMRC funding.
AGB receives funding from NHMRC and QLD Government.
PC receives funding from NHMRC, NIH and several other national and international health funding agencies.
NG receives funding from NHMRC, ARC, NIHR, QLD Government, and is the academic director of the Australian Centre for Health Services Innovation.

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26 **Abstract – word count: 272**

27 **Objective** To estimate the time spent by researchers preparing grant proposals, and to
28 examine whether spending more time increases the chance of success.

29 **Design** Observational study.

30 **Setting** The National Health and Medical Research Council (NHMRC) of Australia.

31 **Participants** Researchers who submitted one or more NHMRC Project Grant proposals in
32 March 2012.

33 **Main outcome measures** Total researcher time spent preparing proposals; funding success
34 as predicted by time spent.

35 **Results** The NHMRC received 3,727 proposals of which 3,570 were reviewed and 731
36 (21%) were funded. Among 285 participants who submitted 632 proposals, 21% were
37 successful. Preparing a new proposal took an average of 38 working days of researcher time
38 and a resubmitted proposal took 28 working days; an overall average of 34 days per proposal.
39 An estimated 550 working years of researchers' time (95% confidence interval 513, 589) was
40 spent preparing the 3,727 proposals, which translates into annual salary costs of AUD\$66
41 million. More time spent preparing a proposal did not increase the chances of success for the
42 lead researcher (prevalence ratio (PR) of success for 10 day increase = 0.91, 95% credible
43 interval 0.78, 1.04) or other researchers (PR= 0.89, 95% CI 0.67, 1.17).

44 **Conclusions** Considerable time is spent preparing NHMRC Project Grant proposals. As
45 success rates are historically 20–25%, much of this time has no immediate benefit to either
46 the researcher or society and there are large opportunity costs in lost research output. The
47 application process could be shortened so that only information relevant for peer review, not
48 administration, is collected. This would have little impact on the quality of peer review and
49 the time saved could be re-invested into research.

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Article summary

Article focus

- Researchers would prefer to spend less time preparing grant proposals and more time on actual research.
- The time spent preparing grant proposals is thought to be large, but we do not have accurate estimates of the total time spent across Australia.

Key messages

- An estimated 550 working years of researchers’ time was spent preparing proposals for Australia’s major health and medical funding scheme.
- More time spent preparing a proposal did not increase the chances of success and there was no agreement between researchers’ ranking of their proposals and the results from peer review.
- Most researchers understand that a perfect peer review system is not realistic.

Strengths and limitations of this study

- Our time estimates were retrospective, with no details on identifying the sections of the proposal that took the most time.
- We used a short survey to increase the response rate, but this means we have limited data on the participants and their institutions.
- Many researchers were reluctant to give us their proposal identification numbers, presumably because of confidentiality concerns.

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72 INTRODUCTION

73

74 Project Grants are the major source of medical research funding in Australia, and were
75 around 70% of all research funds awarded by the National Health and Medical Research
76 Council (NHMRC) in 2012 [1]. While the amount of available funding has increased over
77 time, the increase has not matched the growing number of proposals (there were 1,906
78 proposals in 2003 and 3,727 in 2012, a 96% increase). For Australian researchers, this
79 increase in proposal numbers has led to declining success rates and budget cuts for successful
80 proposals.

81

82 Project Grants aim to support single or small teams of researchers for a defined project from
83 one to five years. The application process takes almost a year, and has remained essentially
84 the same for the last decade. The funding round opens in December, full proposals are
85 submitted online in March, assessed by two external reviewers (April–May), lead researchers
86 provide responses to the reviewers' reports (May), grant review panels of 10–12 experts
87 assess each proposal considering reports from two panel spokespersons and give each
88 proposal a score (August–September). Funding is then allocated based on a ranking
89 determined by the score until the budget is exhausted, and the successful proposals are
90 announced (October–November). The budget for Project Grants beginning in 2013 was AUD
91 \$458 million.

92

93 The process Australia uses, involving the assessment of full proposals, is in contrast to
94 several comparable funding bodies overseas which use staggered application processes. For
95 example, the UK Wellcome Trust Investigator Awards first invite a research plan; shortlisted
96 applicants are then invited to provide more information [2]. The UK Engineering and

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Physical Sciences Research Council (EPSRC) have a similar staggered process for their Platform Grants [3], as do the USA National Science Foundation (NSF). The NSF’s guidelines explain that a key reason for short-listing is to reduce the wasted effort of researchers spending time preparing proposals with a low chance of success [4].

Despite the importance of applying for research funding, the total time spent by researchers preparing and submitting proposals is not known [5]. Guidelines on how to effectively write grant proposals advise they cannot be written in a short amount of time [6], but we do not know if spending more time increases the chance of success. A Nobel Laureate in Physics, and Australian-based researcher, Professor Brian Schmidt recently highlighted the large amount of time Australian researchers were wasting on preparing lengthy proposals for Australian Research Council funding [7].

We surveyed the Australian medical research community in order to estimate their time spent preparing proposals and whether spending more time increased their chance of success. We also examined whether previous experience with peer review improved their success.

METHODS

Study design

In March 2012, Australian researchers working in health and medicine submitted 3,727 proposals to the NHMRC Project Grant funding scheme [8]. We attempted to contact the lead researchers of every proposal by contacting the offices of research of every Australian university and research institute. Of the 51 offices approached, 30 (59%) agreed to distribute

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122 an e-mail invitation to their researchers. There was no reminder e-mail. Willing researchers
123 completed a short online survey from March to May 2012. The funding outcomes were
124 announced by the NHMRC in October 2012. This study was approved by the Queensland
125 University of Technology Ethics Committee (approval number 1100001472).

126

127 *Survey questions*

128

129 The online survey asked researchers to consider their time spent on proposals submitted in
130 March 2012. For each proposal we asked them if they were the lead researcher and how
131 much time they spent (in days). We also asked them about their previous experience with the
132 peer review system as a reviewer and expert panel member, which are roughly akin to being a
133 peer reviewer for a journal and part of the editorial board. We asked for their salary in order
134 to estimate the financial costs of preparing proposals. To protect the anonymity of our
135 participants, and to minimise their time spent completing the survey, we did not ask them for
136 extra personal details or for the name of their institution.

137

138 For researchers who submitted two or more proposals we asked them to rank their proposals
139 in order of which most deserved funding. Researchers also responded to a hypothetical
140 scenario concerning their desired level of reliability between two independent peer review
141 panels (Box 1). This was used to estimate the desired reliability of the peer review process.
142 The hypothetical numbers of 100 proposals and 20 funded were based on a realistic NHMRC
143 Project Grant panel.

144

Response options: Exactly the same 20 proposals, a difference of 1 proposal, [...], 20 completely different proposals.

spent, number of researchers and proportion of resubmissions [9]. Of the 3,727 proposals

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submitted, 18 were subsequently withdrawn [8]. These withdrawn proposals were included in our estimate of the total time, as this time is still valid for our aim of capturing the total researcher time spent preparing proposals across Australia.

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We used logistic regression to estimate the prevalence ratio of success according to researcher experience and time spent on the proposal. Prevalence ratios are the ratio of two probabilities, whereas odds ratios are the ratio of two odds [10]. Using prevalence ratios allows us to make multiplicative statements about probabilities (e.g., twice as likely) that are not possible with odds ratios.

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There were small amounts of missing data (0–7%) for the questions on researcher experience and times. These missing data were imputed using multiple imputation based on the observed responses. For example, 35% said they had previously served on a peer review panel, hence missing values to this question were randomly imputed as “Yes” with probability 0.35.

The imputation and logistic regression model were performed simultaneously using a Bayesian model, hence the final estimates of the prevalence ratios for success incorporate the uncertainty due to missing data. The model was fitted using the Bayesian WinBUGS software [11] and the prevalence ratios are presented as means with 95% credible intervals (CIs).

180

We examined potential non-linear associations between time spent and success. These were: a threshold beyond which more time did not increase the probability of success, log-transformed time and a quadratic association; but found no statistically significant associations (results not shown). We compared the researchers’ ranking of their proposals with their success or failure in the peer review system. For each pair of proposals from the same researcher we compared their relative low and high ranking with their funding success

(yes or no). We only examined those proposals where there was a difference in success, as pairs of grants that were both failures or both successes contain no information for this analysis. We examined these results using a two-by-two table, chi-squared test and Kappa agreement statistic.

RESULTS

Our online survey was started by 446 researchers, but only 285 (64%) provided us with their proposal number(s). We needed the proposal identification numbers in order to match the survey responses (completed from March to May 2012) with the success outcomes from the NHMRC (announced in October 2012). However, many researchers were reluctant to give us this information. The 285 who gave us their proposal numbers submitted 632 proposals. The funding success rate in our sample was 21%, the same as the overall NHMRC success rate (21%) which indicates that our sample was representative of the wider population. The NHMRC received 3,727 proposals of which 3,570 were reviewed, and 731 were funded, giving a success rate of 21% [8].

An estimated 550 working years of researchers' time was spent preparing the 3,727 proposals (95% confidence interval: 513, 589 working years). Based on the researchers' salaries, this is an estimated monetary cost of AUD\$66 million per year, which is 14% of the NHMRC's total funding budget. Each new proposal took an average of 38 working days of researcher time, and resubmissions took an average of 28 working days; an overall average of 34 days per proposal.

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211 More time spent on the proposal did not increase the probability of success (Table 1). Due to
212 concern about a lack of power to detect an association between time spent and success, we
213 used a retrospective power calculation. We had a 90% power to detect an increase in the
214 probability of success of 0.028 for a 10 day increase in time spent (based on the observed
215 times and successes of our sample). If we have missed a true association, it is likely to be
216 smaller than a 0.028 increase in probability for 10 more days of time spent.

217

218 Experience with the peer review system, as either a reviewer or expert panel member, did
219 increase the probability of success but these increases were not statistically significant
220 (Table 1). Resubmitted proposals had a statistically significant lower probability of success
221 compared with new proposals (prevalence ratio = 0.64, 95% CI: 0.43, 0.92).

222

223 There was no agreement between the researchers' rankings of their proposals and which ones
224 were funded (Table 2). The chi-squared test showed no association ($X^2 = 0.93$, p-
225 value = 0.34), and the Kappa agreement was negative (-0.06).

226

227 Researchers were willing to accept a wide range in reliability between two hypothetical peer
228 review processes (Figure 1). The modal response was a difference of 5 proposals (meaning
229 15 the same), which is a 25% disagreement in funding between the two processes.

230

231 **DISCUSSION**

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233 Australian researchers spend an enormous amount of time preparing grant proposals. We
234 estimate that the 2012 NHMRC Project Grant scheme cost 550 working years of researchers'
235 time, which is AUD\$66 million in terms of estimated salary costs. To put this quantum of

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resources into perspective, it exceeds the total annual staff costs at the Walter and Eliza Hall Institute (WEHI 2012, AUD\$61.6 million), one of Australia’s major medical institutes who produced 284 publications in 2012 [12].

As success rates for the Project Grant scheme are historically between 20% to 25%, the majority of time spent preparing proposals is wasted with no immediate benefit. Some wasted time will be salvaged by submitting failed proposals to other funding agencies or resubmitting next year. However, resubmissions took just 10 days less on average to prepare than new submissions, and resubmissions had a 36% lower probability of success (Table 1).

Spending more time on a proposal is no predictor of success (Table 1), and the poor agreement between researchers’ rankings and funding success (Table 2) further demonstrate how hard it is to predict success and justify spending more time on proposals. These findings are consistent with previous studies on NHMRC Project Grants that have shown a high degree of variation in panel members’ scores [13] and a low correlation between the scores assigned for track record and bibliometric measures [14].

Underestimating time and cost

Our cost estimates are likely to underestimate the true costs because some proposals are started but not submitted, and we did not capture the time of researchers who provided technical help or administrative staff who helped with the submission process. Also, our estimates do not include the costs of peer review, which would be the time of one to three external reviewers per proposal and an expert panel of 10–12 senior researchers meeting for a week, as well as the administrative time of organising this peer review.

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262 Our findings are based on retrospective self-reported times spent preparing proposals, and we
263 could not verify these times. Our study was designed to minimise participant burden and
264 maximise our response rate by using a short survey that maintained anonymity. Participants
265 completed our survey soon after the NHMRC closing date for submissions which should
266 have reduced recall bias. At the time of completing the survey participants did not know if
267 their proposal had succeeded, hence our results are not biased by disgruntled researchers
268 inflating their times. Future research may use diaries to prospectively collect the time spent
269 preparing proposals and identify the sections of the proposal that took the most time. We
270 could also examine whether preparing a proposal that remains unfunded provides any longer
271 term benefits to the researcher in terms of refining their scientific ideas.

272

273 *Excessive information*

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275 Researchers would prefer to spend less time writing proposals and more time on actual
276 research. Our results show that most researchers do not expect a perfect system (Figure 1).
277 Hence the amount of information collected does not need to aim for the “ideal” system shown
278 in Figure 2. Most researchers understand that a perfect system is unachievable. The
279 hypothetical association between the information that the system collects (which determines
280 the time spent by researchers) and the accuracy of the system is plotted in Figure 2.
281 Underlying the figure is the notion that the marginal cost of providing more information is
282 rising (which is consistent with our results regarding time spent on grant preparation and
283 success) and the marginal benefit flowing from this information in improving the ranking of
284 proposals is declining [15]. The standard way of optimising the amount of information
285 collected is to equate the marginal benefits with the marginal costs – which occur at the

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286 maximum net benefit. Importantly, beyond this point marginal costs to the applicant
287 outweigh the benefits even though there may still be improvements in accuracy of ranking.
288 One may also reach a point where the net benefits become negative, when additional
289 information only confuses the ranking process.
290
291 Our results suggest that the current NHMRC Project Grant system collects more information
292 than is necessary as the association between time spent (at an individual level) and success
293 was negative (Table 1), putting it on the downward slope of Figure 2. Project Grant proposals
294 are between 80 and 120 pages long, and panel members are expected to read and rank
295 between 50 to 100 proposals. It is optimistic to expect accurate judgements in this sea of
296 excessive information. An alternative application process is to use an initial short proposal
297 with successful proposals being asked to provide more information that would then be used to
298 determine funding.
299
300 *Recommendations to minimise burden*
301
302 Our time estimates are comparable with two small Australian studies on time spent preparing
303 proposals for NHMRC Project Grants. In 2004 a sample of 69 researchers spent an average of
304 20 days per proposal [16]. In 2009 a sample of 42 lead researchers spent between 20 to 30
305 days per proposal, which, when extrapolated to the whole of Australia, gave an estimated
306 total preparation costs of AUD\$41 million [13]. In 2012, the Canadian Institutes of Health
307 Research review of their Open Operating Grant Program included a survey of 378 researchers
308 who spent on average 169 hours (or 23 7.5-hour working days) per proposal [17]. In Canada,
309 new recommended reforms include an immediate reduction in the amount of information
310 submitted to minimise burden on applicants and peer reviewers [17].

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312 A recent review of health and medical research funding in Australia recommended that the
313 NHMRC's online application process be simplified [18]. We agree, but also believe that the
314 information requested for each proposal could be reduced. This is because the key scientific
315 information used to judge a Project Grant's worthiness is just nine pages of a proposal that is
316 between 80 to 120 pages. Therefore proposals could easily be shortened without any impact
317 on peer review. The inclusion of a staged application process starting with an expression of
318 interest (EOI), as used in the UK and USA, would further minimise the burden on
319 researchers. If an EOI could be used to reject 30% of proposals, and assuming that an EOI
320 takes one-quarter of the time to prepare as a full proposal, then (based on our survey) this
321 would save 124 years of researcher time per year. This saved time is equivalent to funding
322 124 new post-doctoral positions per year.

323

324 Changes to eligibility rules for resubmitting proposals from previous funding rounds could
325 reduce the total number of applications and improve success rates. In the UK proposals
326 submitted to the EPSRC Platform Grant scheme (2009–2010 to 2011–2012) have almost
327 halved (3379 versus 1938) and the success rate increased (30% versus 41%) after EPSRC
328 implemented stricter eligibility rules including a Repeatedly Unsuccessful Applicants policy
329 [3]. From our survey, the success rate for new proposals was higher than for resubmissions
330 therefore limitations on the resubmission of Project Grants may reduce the time wasted
331 preparing proposals by improving the chance of success.

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333 The format of grant proposals could be shortened so that only information relevant for peer
334 review, not administration, is collected. Further, the administrative data could be collected at
335 a later date for only those proposals that were successful. Another option is to restructure the

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format of proposals based on the total budget, where projects with smaller budgets can submit shorter proposals. The potential savings in researcher time are enormous as preparing research proposals takes between 1 to 3 months of the year. If more of this time could be dedicated to actual research then there would be more and faster medical research discoveries. Weighing down researchers in a lengthy grant proposal process is a poor use of valuable researcher time.

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Contributorship

AGB, PC and NG conceived and designed the study, and analysed the data. All authors interpreted the data, drafted the article or revised it critically for important intellectual content and approved the version to be published. AGB is the study chief investigator and acts as the guarantor.

Data Sharing

No additional data are available.

Competing Interests

DLH salary is supported from NHMRC funding.

AGB receives funding from NHMRC and QLD Government.

PC receives funding from NHMRC, NIH and several other national and international health funding agencies.

NG receives funding from NHMRC, ARC, NIHR, QLD Government, and is the academic director of the Australian Centre for Health Services Innovation.

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REFERENCES

1. National Health and Medical Research Council. Funding Rate and Funding by Funding Scheme. Canberra: NHMRC, 19 Oct 2012.
<http://www.nhmrc.gov.au/grants/outcomes-funding-rounds> (accessed Nov 2012).
2. Wilkinson E. Wellcome Trust to fund people not projects. *Lancet* 2010; 375: 185-186.
3. Engineering and Physical Sciences Research Council. Research Proposal Funding Rates 2011-2012. Swindon: EPSRC, 2012.
<http://www.epsrc.ac.uk/SiteCollectionDocuments/funding/FundingRates1112.pdf> (accessed Jan 2013).
4. National Science Foundation. Grant proposal guide. Arlington VA: NSF, 2011. p I-3.
<http://www.nsf.gov/pubs/policydocs/pappguide/nsf11001/gpgprint.pdf> (accessed Nov 2012).
5. Wood FQ, Meek VL, Harman G. The research grant application process. Learning from failure? *Higher Education* 1992; 24: 1-23.
6. Kreeger K. A winning proposal. *Nature* 2003; 423: 102-103.
7. Schmidt B. We must rebuild our grants system. *The Australian*. 2012 Nov 14. Section: Opinion.
<http://www.theaustralian.com.au/higher-education/opinion/we-must-rebuild-our-grants-system/story-e6frgcko-1226516110682> (accessed Nov 2012).
8. National Health and Medical Research Council. Project Grants for funding commencing in 2013. Canberra: NHMRC, 19 Oct 2012.
https://www.nhmrc.gov.au/_files_nhmrc/file/grants/funding/funded/2012/project_grants_funding%20commencing_2013_121018_1.docx (accessed Nov 2012).

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386 9. Davison AC, Hinkley DV. Bootstrap methods and their application. Cambridge:
387 Cambridge University Press, 1997.

388 10. Deddens JA, Petersen MR. Approaches for estimating prevalence ratios. *Occup*
389 *Environ Med* 2008; 65: 501-506.

390 11. Lunn DJ, Thomas A, Best N, Spiegelhalter, D. WinBUGS - A Bayesian modelling
391 framework: concepts, structure, and extensibility. *Stat Comput* 2000; 10: 325-337.

392 12. Walter and Eliza Hall Institute of Medical Research. Annual Report 2011-2012.
393 Melbourne: WEHI, 2012. p168.
394 http://www.wehi.edu.au/uploads/11-12_WEHI_Annual_Report.pdf (accessed Feb
395 2013).

396 13. Graves N, Barnett AG, Clarke P. Funding grant proposals for scientific research:
397 retrospective analysis of scores by members of grant review panel. *BMJ* 2011; 343:
398 d4797.

399 14. Nicol MB, Henadeera K, Butler L. NHMRC grant applications: a comparison of
400 “track record” scores allocated by grant assessors with bibliometric analysis of
401 publications. *Med J Aust* 2007; 187: 348-352.

402 15. Thomas CR, Maurice SC. Managerial Economics. 9th edition. Boston: McGraw-Hill
403 Irwin, 2008.

404 16. Mow KE. Inside the black box: research grant funding and peer review in Australian
405 research councils. LAP Lambert Academic Publishing. 2010. p188-191

406 17. Canadian Institutes of Health Research. Evaluation of the Open Operating Grant
407 Program: final report. Ontario:CIHR, 2012. [http://www.cihr-](http://www.cihr-irsc.gc.ca/e/documents/oogp_evaluation_report_2012_e.pdf)
408 [irsc.gc.ca/e/documents/oogp_evaluation_report_2012_e.pdf](http://www.cihr-irsc.gc.ca/e/documents/oogp_evaluation_report_2012_e.pdf) (accessed Feb 2013)

409 18. Strategic Review of Health and Medical Research in Australia. Consultation paper
410 summary: issues and proposed recommendations. Draft for public comment.

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411 Canberra: DOHA, 2012.

412 http://www.mckeonreview.org.au/downloads/SRHMRA_Consultation_Paper_Summary_Revised.pdf (accessed Nov 2012).

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For peer review only

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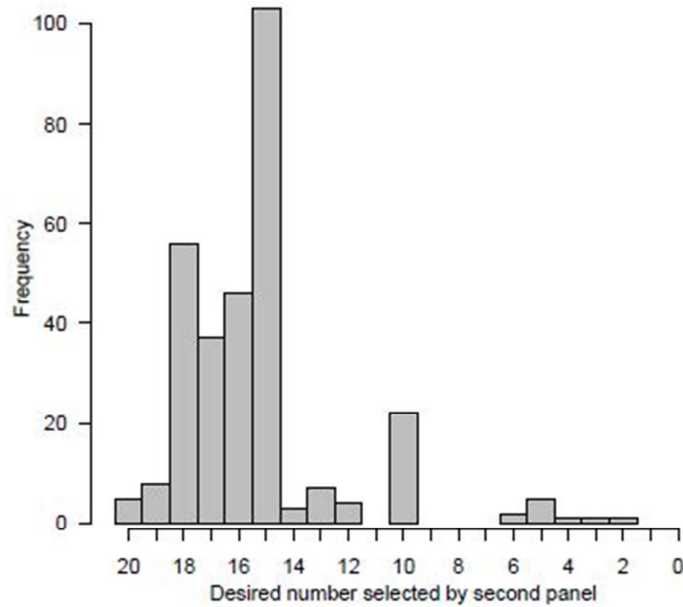
415 Table 1 Prevalence ratios of funding success by researcher experience and time spent on
416 proposal

Researcher's experience and time	PR	95% CI
Ever served on peer review panel (Yes vs No)	1.27	0.89, 1.74
Ever peer reviewed a proposal (Yes vs No)	1.33	0.78, 2.22
Salary (per \$5000 increase)	0.99	0.94, 1.04
Resubmitted proposal (Yes vs No)	0.64	0.43, 0.92
Time for lead researchers (10 day increase)	0.91	0.78, 1.04
Time for other researchers (10 day increase)	0.89	0.67, 1.17

417 CI = credible interval

420 Table 2 Agreement between researchers' relative ranking of their proposals and funding
421 success.

Researcher's ranking	Funding success	
	No	Yes
Low	82	92
High	92	82
Kappa agreement	-0.06	



424 Figure 1: Desired reliability of a hypothetical system (see Box 1 for hypothetical question)

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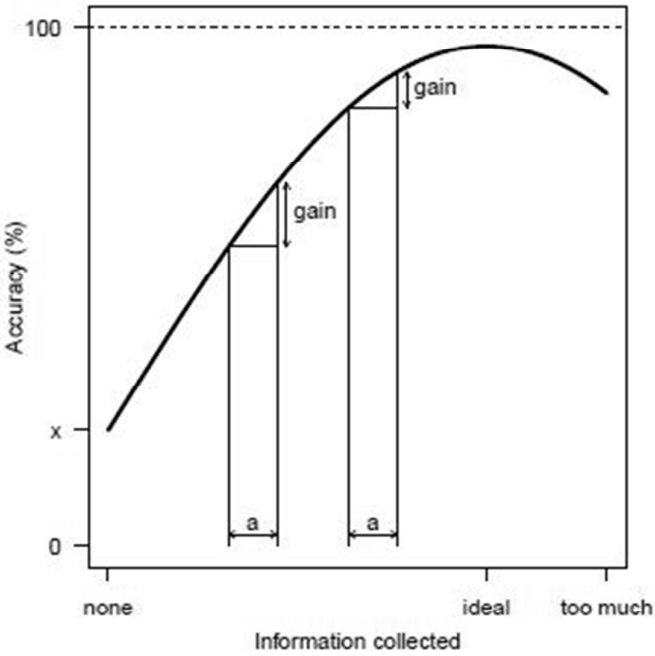


Figure 2: Hypothetical association between the information collected for peer review and the accuracy of awarding the best proposals. To draw this association we assume that all proposals can be ranked (without ties) from the best to the worst.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1,2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4,5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5,6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5,6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5,6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7-9
		(b) Describe any methods used to examine subgroups and interactions	8,9
		(c) Explain how missing data were addressed	8
		(d) If applicable, describe analytical methods taking account of sampling strategy	7-9
		(e) Describe any sensitivity analyses	8,9
		Results	

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	9
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	8
Outcome data	15*	Report numbers of outcome events or summary measures	9
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10, Tables 1-2, Figure 1
		(b) Report category boundaries when continuous variables were categorized	n/a
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	8, Table 1
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	10, Tables 1-2, Figure 1
Discussion			
Key results	18	Summarise key results with reference to study objectives	10,11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11,12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	13-15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.



On the time spent preparing grant proposals: an observational study of Australian researchers

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On the time spent preparing grant proposals 1

Title

On the time spent preparing grant proposals: an observational study of Australian researchers

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Contributors

AGB, PC and NG conceived and designed the study, and analysed the data. All authors interpreted the data, drafted the article or revised it critically for important intellectual content and approved the version to be published. AGB is the study chief investigator and is the guarantor.

Competing interests

DLH salary is supported from NHMRC funding.
AGB receives funding from NHMRC and QLD Government.
PC receives funding from NHMRC, NIH and several other national and international health funding agencies.
NG receives funding from NHMRC, ARC, NIHR, QLD Government, and is the academic director of the Australian Centre for Health Services Innovation.

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On the time spent preparing grant proposals

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26 **Abstract – word count: 274**

27 **Objective** To estimate the time spent by researchers preparing grant proposals, and to
28 examine whether spending more time increases the chance of success.

29 **Design** Observational study.

30 **Setting** The National Health and Medical Research Council (NHMRC) of Australia.

31 **Participants** Researchers who submitted one or more NHMRC Project Grant proposals in
32 March 2012.

33 **Main outcome measures** Total researcher time spent preparing proposals; funding success
34 as predicted by time spent.

35 **Results** The NHMRC received 3,727 proposals of which 3,570 were reviewed and 731
36 (21%) were funded. Among our 285 participants who submitted 632 proposals, 21% were
37 successful. Preparing a new proposal took an average of 38 working days of researcher time
38 and a resubmitted proposal took 28 working days; an overall average of 34 days per proposal.
39 An estimated 550 working years of researchers' time (95% confidence interval 513, 589) was
40 spent preparing the 3,727 proposals, which translates into annual salary costs of AUD\$66
41 million. More time spent preparing a proposal did not increase the chances of success for the
42 lead researcher (prevalence ratio (PR) of success for 10 day increase = 0.91, 95% credible
43 interval (CI) 0.78, 1.04) or other researchers (PR= 0.89, 95% CI 0.67, 1.17).

44 **Conclusions** Considerable time is spent preparing NHMRC Project Grant proposals. As
45 success rates are historically 20–25%, much of this time has no immediate benefit to either
46 the researcher or society, and there are large opportunity costs in lost research output. The
47 application process could be shortened so that only information relevant for peer review, not
48 administration, is collected. This would have little impact on the quality of peer review and
49 the time saved could be re-invested into research.

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On the time spent preparing grant proposals

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51 **Article summary**

52 **Article focus**

- 53 • Researchers would prefer to spend less time preparing grant proposals and more time on
54 actual research.
- 55 • The time spent preparing grant proposals is thought to be large, but we do not have
56 accurate estimates of the total time spent across Australia.

57 **Key messages**

- 58 • An estimated 550 working years of researchers' time was spent preparing proposals for
59 Australia's major health and medical funding scheme.
- 60 • More time spent preparing a proposal did not increase the chances of success and there
61 was no agreement between researchers' ranking of their proposals and the results from
62 peer review.
- 63 • Most researchers understand that a perfect peer review system is not realistic.

64 **Strengths and limitations of this study**

- 65 • Our time estimates were retrospective, with no details on identifying the sections of the
66 proposal that took the most time.
- 67 • We used a short survey to increase the response rate, but this means we have limited data
68 on the participants and their institutions.
- 69 • Many researchers were reluctant to give us their proposal identification numbers,
70 presumably because of confidentiality concerns.

71

On the time spent preparing grant proposals

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72 INTRODUCTION

73 Project Grants are the major source of medical research funding in Australia, and were
74 around 70% of all research funds awarded by the National Health and Medical Research
75 Council (NHMRC) in 2012 [1]. Application numbers have steadily risen over time making
76 the process more competitive; there were 1,881 proposals in 2003 and 3,727 in 2012, a 98%
77 increase. For Australian researchers, this increase in proposal numbers has led to declining
78 success rates and budget cuts for successful proposals.

80 Project Grants aim to support single or small teams of researchers for a defined project from
81 one to five years. The application process takes almost a year, and has remained essentially
82 the same for the last decade. The funding round opens in December, full proposals are
83 submitted online in March, assessed by two external reviewers (April–May), lead researchers
84 provide responses to the reviewers' reports (May), grant review panels of 10–12 experts
85 assess each proposal considering reports from two panel spokespersons and the applicants'
86 responses to the reviewers' reports, and give each proposal a score (August–September).
87 Funding is then allocated based on a ranking determined by the score until the budget is
88 exhausted, and the successful proposals are announced (October–November). The budget for
89 Project Grants beginning in 2013 was AUD \$458 million.

91 The process Australia uses, involving the assessment of full proposals, is in contrast to
92 several comparable funding bodies overseas which use staggered application processes. For
93 example, the UK Wellcome Trust Investigator Awards first invite a research plan; shortlisted
94 applicants are then invited to provide more information [2]. The UK Engineering and
95 Physical Sciences Research Council (EPSRC) have a similar staggered process for their
96 Platform Grants [3], as do the USA National Science Foundation (NSF). The NSF's

97 guidelines explain that a key reason for short-listing is to reduce the wasted effort of
98 researchers spending time preparing proposals with a low chance of success [4].
99
100 Despite the importance of applying for research funding, the total time spent by researchers
101 preparing and submitting proposals is not known [5]. Guidelines on how to effectively write
102 grant proposals advise they cannot be written in a short amount of time [6], but we do not
103 know if spending more time increases the chance of success. A Nobel Laureate in Physics,
104 and Australian-based researcher, Professor Brian Schmidt recently highlighted the large
105 amount of time Australian researchers were wasting on preparing lengthy proposals for
106 Australian Research Council funding [7].
107
108 We surveyed the Australian medical research community in order to estimate their time spent
109 preparing proposals and whether spending more time increased their chance of success. We
110 also examined whether previous experience with peer review improved their success.

112 **METHODS**

113 *Study design*

114 In March 2012, Australian researchers working in health and medicine submitted 3,727
115 proposals to the NHMRC Project Grant funding scheme [8]. We attempted to contact the lead
116 researchers of every proposal by contacting the offices of research of every Australian
117 university and research institute. Of the 51 offices approached, 30 (59%) agreed to distribute
118 an e-mail invitation to their researchers. There was no reminder e-mail. Willing researchers
119 completed a short online survey from March to May 2012. The funding outcomes were
120 announced by the NHMRC in October 2012. This study was approved by the Queensland
121 University of Technology Ethics Committee (approval number 1100001472).

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123 *Survey questions*

124 The online survey asked researchers to consider their time spent on proposals submitted in
125 March 2012. For each proposal we asked them if they were the lead researcher and how
126 much time they spent (in days), and whether the proposal was new or a resubmission. We
127 also asked them about their previous experience with the peer review system as a reviewer
128 and expert panel member, which are roughly akin to being a peer reviewer for a journal and
129 part of the editorial board. We asked for their salary in order to estimate the financial costs of
130 preparing proposals. To protect the anonymity of our participants, and to minimise their time
131 spent completing the survey, we did not ask them for extra personal details or for the name of
132 their institution.

133

134 For researchers who submitted two or more proposals we asked them to rank their proposals
135 in order of which most deserved funding. Researchers also responded to a hypothetical
136 scenario concerning their desired level of reliability between two independent peer review
137 panels (Box 1). This was used to estimate the desired reliability of the peer review process.
138 The hypothetical numbers of 100 proposals and 20 funded were based on a realistic NHMRC
139 Project Grant panel.

140

141

Question: Imagine that 100 Project Grant proposals in the same field have been reviewed by a panel of 10 experts. They selected 20 proposals for funding.

Response options: Exactly the same 20 proposals, a difference of 1 proposal, [...], 20 completely different proposals.

143

145 The total number of days spent preparing proposals was estimated using the following
146 equation:

148 where 3,727 is the total number of proposals in 2012, P is the proportion of resubmitted

149 proposals, $T()$ is the average time spent in days for a combination of new or resubmitted (N

150 or R) proposals, lead or other researchers (L or O), and M is the average number of

151 researchers per proposal. This equation recognises that resubmitted proposals usually take

152 less time than new proposals, and that lead researchers generally spend more time than the

153 other researchers. This estimate on the scale of working days was scaled to working years by

154 assuming 46 working weeks per year. A bootstrap 95% confidence interval was calculated by

155 randomly re-sampling from the observed responses to capture the uncertainty in the time

156 spent, number of researchers and proportion of resubmissions [9]. Of the 3,727 proposals

submitted, 18 were subsequently withdrawn [8]. These withdrawn proposals were included in

On the time spent preparing grant proposals

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our estimate of the total time, as this time is still valid for our aim of capturing the total researcher time spent preparing proposals across Australia.

160

We used logistic regression to estimate the prevalence ratio of success according to researcher experience and time spent on the proposal. Prevalence ratios are the ratio of two probabilities, whereas odds ratios are the ratio of two odds [10]. Using prevalence ratios allows us to make multiplicative statements about probabilities (e.g., twice as likely) that are not possible with odds ratios.

166

There were small amounts of missing data (0–7%) for the questions on researcher experience and times. These missing data were imputed using multiple imputation based on the observed responses. For example, 35% said they had previously served on a peer review panel, hence missing values to this question were randomly imputed as “Yes” with probability 0.35.

The imputation and logistic regression model were performed simultaneously using a Bayesian model, hence the final estimates of the prevalence ratios for success incorporate the uncertainty due to missing data. The model was fitted using the Bayesian WinBUGS software [11] and the prevalence ratios are presented as means with 95% credible intervals (CIs).

175

We examined potential non-linear associations between time spent and success. These were: a threshold beyond which more time did not increase the probability of success, log-transformed time and a quadratic association; but found no statistically significant associations (results not shown).

180

We compared the researchers’ ranking of their proposals with their success or failure in the peer review system. For each pair of proposals from the same researcher we compared their

relative low and high ranking with their funding success (yes or no). We only examined those proposals where there was a difference in success, as pairs of grants that were both failures or both successes contain no information for this analysis. We examined these results using a two-by-two table, chi-squared test and Kappa agreement statistic.

RESULTS

Our online survey was started by 446 researchers, but only 285 (64%) provided us with their proposal number(s). We needed the proposal numbers in order to match the survey responses (completed from March to May 2012) with the success outcomes from the NHMRC (announced in October 2012). However, many researchers were reluctant to give us this information. The 285 who gave us their proposal numbers submitted 632 proposals. The funding success rate in our sample was 21%, the same as the overall NHMRC success rate (21%) which indicates that our sample was representative of the wider population. The NHMRC received 3,727 proposals of which 3,570 were reviewed, and 731 were funded, giving a success rate of 21% [8].

An estimated 550 working years of researchers' time was spent preparing the 3,727 proposals (95% confidence interval: 513, 589 working years). Based on the researchers' salaries, this is an estimated monetary cost of AUD\$66 million per year, which is 14% of the NHMRC's total funding budget. Each new proposal took an average of 38 working days of researcher time, and resubmissions took an average of 28 working days; an overall average of 34 days per proposal. Lead researchers spent an average of 27 and 21 workings days per new and resubmitted proposals, respectively, with the remaining time spent by other researchers.

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207 More time spent on the proposal did not increase the probability of success (Table 1). Due to
208 concern about a lack of power to detect an association between time spent and success, we
209 used a retrospective power calculation. We had a 90% power to detect an increase in the
210 probability of success of 0.028 for a 10 day increase in time spent (based on the observed
211 times and successes of our sample). If we have missed a true association, it is likely to be
212 smaller than a 0.028 increase in probability for 10 more days of time spent.

213

214 Experience with the peer review system, as either a reviewer or expert panel member, did
215 increase the probability of success but these increases were not statistically significant
216 (Table 1). Resubmitted proposals had a statistically significant lower probability of success
217 compared with new proposals (prevalence ratio = 0.64, 95% CI: 0.43, 0.92).

218

219 There was no agreement between the researchers' rankings of their proposals and which ones
220 were funded (Table 2). The chi-squared test showed no association ($X^2 = 0.93$, p-
221 value = 0.34), and the Kappa agreement was negative (-0.06).

222

223 Researchers were willing to accept a wide range in reliability between two hypothetical peer
224 review processes (Figure 1). The modal response was a difference of 5 proposals (meaning
225 15 the same), which is a 25% disagreement in funding between the two processes.

226

227 **DISCUSSION**

228 Australian researchers spend an enormous amount of time preparing grant proposals [12]. We
229 estimate that the 2012 NHMRC Project Grant scheme cost 550 working years of researchers'
230 time, which is AUD\$66 million in terms of estimated salary costs. To put this quantum of
231 resources into perspective, it exceeds the total annual staff costs at the Walter and Eliza Hall

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Institute (WEHI 2012, AUD\$61.6 million), one of Australia’s major medical institutes who produced 284 peer-reviewed publications in 2012 [13].

As success rates for the Project Grant scheme are historically between 20% to 25%, the majority of time spent preparing proposals is wasted with no immediate benefit due to the failure to obtain funding. Some wasted time will be salvaged by submitting failed proposals to other funding agencies or resubmitting next year. However, resubmissions took just 10 days less on average to prepare than new submissions, and resubmissions had a 36% lower probability of success (Table 1).

Spending more time on a proposal is no predictor of success (Table 1), and the poor agreement between researchers’ rankings and funding success (Table 2) further demonstrate how hard it is to predict success and justify spending more time on proposals. These findings are consistent with previous studies on NHMRC Project Grants that have shown a high degree of variation in panel members’ scores [14] and a low correlation between the scores assigned for track record and bibliometric measures [15].

Underestimating time and cost

Our cost estimates are likely to underestimate the true costs because some proposals are started but not submitted, and we did not capture the time of researchers who provided technical help or administrative staff who helped with the submission process. Also, our estimates do not include the costs of peer review, which would be the time of one to three external reviewers per proposal and an expert panel of 10–12 senior researchers meeting for a week, as well as the administrative time of organising this peer review.

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Our findings are based on retrospective self-reported times spent preparing proposals, and we could not verify these times. Our study was designed to minimise participant burden and maximise our response rate by using a short survey that maintained anonymity. Participants completed our survey soon after the NHMRC closing date for submissions which should have reduced recall bias. At the time of completing the survey participants did not know if their proposal had succeeded, hence our results are not biased by disgruntled researchers inflating their times. Future research could use diaries to prospectively collect the time spent preparing proposals and identify the sections of the proposal that took the most time. Future research could also examine whether preparing unsuccessful proposals provides any benefits to the researchers in terms of refining their scientific ideas.

267

268 *Excessive information*

Researchers would prefer to spend less time writing proposals and more time on actual research [16]. Our results show that most researchers do not expect a perfect system (Figure 1). Hence the amount of information collected does not need to aim for the “ideal” system shown in Figure 2. Most researchers understand that a perfect system is unachievable. The hypothetical association between the information that the system collects (which determines the time spent by researchers) and the accuracy of the system is plotted in Figure 2. Underlying the figure is the notion that the marginal cost of providing more information is rising (which is consistent with our results regarding time spent on grant preparation and success) and the marginal benefit flowing from this information in improving the ranking of proposals is declining [17]. The standard way of optimising the amount of information collected is to equate the marginal benefits with the marginal costs – which occur at the maximum net benefit. Beyond this point, marginal costs to the applicant outweigh the benefits even though there may still be improvements in accuracy of ranking. One may also

reach a point where the net benefits become negative, when additional information only confuses the ranking process.

Our results suggest that the current NHMRC Project Grant system collects more information than is necessary as the association between time spent (at an individual level) and success was negative (Table 1), putting it on the downward slope of Figure 2. Project Grant proposals are between 80 and 120 pages long, and panel members are expected to read and rank between 50 to 100 proposals. It is optimistic to expect accurate judgements in this sea of excessive information. An alternative application process is to use an initial short proposal with successful proposals being asked to provide more information that would then be used to determine funding.

Recommendations to minimise burden

Our time estimates are comparable with two small Australian studies on time spent preparing proposals for NHMRC Project Grants. In 2004 a sample of 69 researchers spent an average of 20 days per proposal [18]. In 2009 a sample of 42 lead researchers spent between 20 to 30 days per proposal, which, when extrapolated to the whole of Australia, gave an estimated total preparation costs of AUD\$41 million [14]. In 2012, the Canadian Institutes of Health Research review of their Open Operating Grant Program included a survey of 378 researchers who spent on average 169 hours (or 23 7.5-hour working days) per proposal [19]. In Canada, new recommended reforms include a reduction in the amount of information submitted to minimise burden on applicants and peer reviewers [19].

A recent review of health and medical research funding in Australia recommended that the NHMRC’s online application process be simplified [20]. We agree, but also believe that the

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information requested for each proposal could be reduced. This is because the key scientific information used to judge a Project Grant's worthiness is just nine pages of a proposal that is between 80 to 120 pages. Therefore proposals could easily be shortened without any impact on peer review. The inclusion of a staged application process starting with an expression of interest (EOI), as used in the UK and USA, would further minimise the burden on researchers. If an EOI could be used to reject 30% of proposals, and assuming that an EOI takes one-quarter of the time to prepare as a full proposal, then (based on our survey) this would save 124 years of researcher time per year. This saved time is equivalent to funding 124 new post-doctoral positions per year.

Changes to eligibility rules for resubmitting proposals from previous funding rounds could reduce the total number of applications and improve success rates. In the UK proposals submitted to the EPSRC Platform Grant scheme (2009–2010 to 2011–2012) have almost halved (3379 versus 1938) and the success rate increased (30% versus 41%) after EPSRC implemented stricter eligibility rules including a Repeatedly Unsuccessful Applicants policy [3]. From our survey, the success rate for new proposals was higher than for resubmissions therefore limitations on the resubmission of Project Grants may reduce the time wasted preparing proposals by improving the chance of success.

The format of grant proposals could be shortened so that only information relevant for peer review, not administration, is collected. The administrative data could be collected at a later date for only those proposals that were successful. Another option is to restructure the format of proposals based on the total budget, where projects with smaller budgets can submit shorter proposals. The potential savings in researcher time are enormous as preparing research proposals takes between 1 to 3 months of the year. If more of this time could be

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dedicated to actual research then there would be more and faster medical research discoveries. Weighing down researchers in a lengthy grant proposal process is a poor use of valuable researcher time.

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DATA SHARING

No additional data available.

REFERENCES

1. National Health and Medical Research Council. Funding Rate and Funding by Funding Scheme. Canberra: NHMRC, 19 Oct 2012.
<http://www.nhmrc.gov.au/grants/outcomes-funding-rounds> (accessed Nov 2012).
2. Wilkinson E. Wellcome Trust to fund people not projects. *Lancet* 2010; 375: 185-186.
3. Engineering and Physical Sciences Research Council. Research Proposal Funding Rates 2011-2012. Swindon: EPSRC, 2012.
<http://www.epsrc.ac.uk/SiteCollectionDocuments/funding/FundingRates1112.pdf> (accessed Jan 2013).
4. National Science Foundation. Grant proposal guide. Arlington VA: NSF, 2011. p I-3.
<http://www.nsf.gov/pubs/policydocs/pappguide/nsf11001/gpgprint.pdf> (accessed Nov 2012).

On the time spent preparing grant proposals

16

- 356 5. Wood FQ, Meek VL, Harman G. The research grant application process. Learning
357 from failure? *Higher Education* 1992; 24: 1-23.
- 358 6. Kreeger K. A winning proposal. *Nature* 2003; 423: 102-103.
- 359 7. Schmidt B. We must rebuild our grants system. *The Australian*. 2012 Nov 14.
360 Section: Opinion.
361 [http://www.theaustralian.com.au/higher-education/opinion/we-must-rebuild-our-](http://www.theaustralian.com.au/higher-education/opinion/we-must-rebuild-our-grants-system/story-e6frgcko-1226516110682)
362 [grants-system/story-e6frgcko-1226516110682](http://www.theaustralian.com.au/higher-education/opinion/we-must-rebuild-our-grants-system/story-e6frgcko-1226516110682) (accessed Nov 2012).
- 363 8. National Health and Medical Research Council. Project Grants for funding
364 commencing in 2013. Canberra: NHMRC, 19 Oct 2012.
365 [https://www.nhmrc.gov.au/_files_nhmrc/file/grants/funding/funded/2012/project_gra](https://www.nhmrc.gov.au/_files_nhmrc/file/grants/funding/funded/2012/project_grants_funding%20commencing_2013_121018_1.docx)
366 [nts_funding%20commencing_2013_121018_1.docx](https://www.nhmrc.gov.au/_files_nhmrc/file/grants/funding/funded/2012/project_grants_funding%20commencing_2013_121018_1.docx) (accessed Nov 2012).
- 367 9. Davison AC, Hinkley DV. Bootstrap methods and their application. Cambridge:
368 Cambridge University Press, 1997.
- 369 10. Deddens JA, Petersen MR. Approaches for estimating prevalence ratios. *Occup*
370 *Environ Med* 2008; 65: 501-506.
- 371 11. Lunn DJ, Thomas A, Best N, et al. WinBUGS - A Bayesian modelling framework:
372 concepts, structure, and extensibility. *Stat Comput* 2000; 10: 325-337.
- 373 12. Herbert DL, Barnett AG, Graves N. Funding: Australia's grant system wastes time.
374 *Nature* 2013; 495 (7441): 314.
- 375 13. Walter and Eliza Hall Institute of Medical Research. Annual Report 2011-2012.
376 Melbourne: WEHI, 2012. p168.
377 http://www.wehi.edu.au/uploads/11-12_WEHI_Annual_Report.pdf (accessed Feb
378 2013).

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54
55
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57
58
59
60

379 14. Graves N, Barnett AG, Clarke P. Funding grant proposals for scientific research:
380 retrospective analysis of scores by members of grant review panel. *BMJ* 2011; 343:
381 d4797.

382 15. Nicol MB, Henadeera K, Butler L. NHMRC grant applications: a comparison of
383 “track record” scores allocated by grant assessors with bibliometric analysis of
384 publications. *Med J Aust* 2007; 187: 348-352.

385 16. Smith R. Classical peer review: an empty gun. *Breast Cancer Res* 2010; 12 Suppl 4:
386 S13.

387 17. Thomas CR, Maurice SC. Managerial Economics. 9th edition. Boston: McGraw-Hill
388 Irwin, 2008.

389 18. Mow KE. Inside the black box: research grant funding and peer review in Australian
390 research councils. LAP Lambert Academic Publishing. 2010. p188-191

391 19. Canadian Institutes of Health Research. Evaluation of the Open Operating Grant
392 Program: final report. Ontario:CIHR, 2012. [http://www.cihr-](http://www.cihr-irsc.gc.ca/e/documents/oogp_evaluation_report_2012_e.pdf)
393 [irsc.gc.ca/e/documents/oogp_evaluation_report_2012_e.pdf](http://www.cihr-irsc.gc.ca/e/documents/oogp_evaluation_report_2012_e.pdf) (accessed Feb 2013)

394 20. Commonwealth of Australia. Strategic Review of Health and Medical Research in
395 Australia – better health through research. Canberra: DOHA, 2013.
396 [http://www.mckeonreview.org.au/downloads/Strategic_Review_of_Health_and_Medi-](http://www.mckeonreview.org.au/downloads/Strategic_Review_of_Health_and_Medical_Research_Feb_2013-Final_Report.pdf)
397 [cal_Research_Feb_2013-Final_Report.pdf](http://www.mckeonreview.org.au/downloads/Strategic_Review_of_Health_and_Medical_Research_Feb_2013-Final_Report.pdf) (accessed Apr 2013)

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On the time spent preparing grant proposals

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399 Table 1 Prevalence ratios of funding success by researcher experience and time spent on
400 proposal

Researcher's experience and time	PR	95% CI
Ever served on peer review panel (Yes vs No)	1.27	0.89, 1.74
Ever peer reviewed a proposal (Yes vs No)	1.33	0.78, 2.22
Salary (per \$5000 increase)	0.99	0.94, 1.04
Resubmitted proposal (Yes vs No)	0.64	0.43, 0.92
Time for lead researchers (10 day increase)	0.91	0.78, 1.04
Time for other researchers (10 day increase)	0.89	0.67, 1.17

401 PR = prevalence ratio, CI = credible interval

402

403

404 Table 2 Agreement between researchers' relative ranking of their proposals and funding
405 success.

Researcher's ranking	Funding success	
	No	Yes
Low	82	92
High	92	82
Kappa agreement	-0.06	

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Figure legends:

Figure 1: Desired reliability of a hypothetical system (see Box 1 for hypothetical question)

Figure 2: Hypothetical association between the information collected for peer review and the accuracy of awarding the best proposals. To draw this association we assume that all proposals can be ranked (without ties) from the best to the worst.

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Title

On the time spent preparing grant proposals: an observational study of Australian researchers

Authors

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Contributors

AGB, PC and NG conceived and designed the study, and analysed the data. All authors interpreted the data, drafted the article or revised it critically for important intellectual content and approved the version to be published. AGB is the study chief investigator and is the guarantor.

Competing interests

DLH salary is supported from NHMRC funding.

AGB receives funding from NHMRC and QLD Government.

PC receives funding from NHMRC, NIH and several other national and international health funding agencies.

NG receives funding from NHMRC, ARC, NIHR, QLD Government, and is the academic director of the Australian Centre for Health Services Innovation.

Word count: 3084

On the time spent preparing grant proposals 2

26 **Abstract – word count: 274**

27 **Objective** To estimate the time spent by researchers preparing grant proposals, and to
28 examine whether spending more time increases the chance of success.

29 **Design** Observational study.

30 **Setting** The National Health and Medical Research Council (NHMRC) of Australia.

31 **Participants** Researchers who submitted one or more NHMRC Project Grant proposals in
32 March 2012.

33 **Main outcome measures** Total researcher time spent preparing proposals; funding success
34 as predicted by time spent.

35 **Results** The NHMRC received 3,727 proposals of which 3,570 were reviewed and 731
36 (21%) were funded. Among our 285 participants who submitted 632 proposals, 21% were
37 successful. Preparing a new proposal took an average of 38 working days of researcher time
38 and a resubmitted proposal took 28 working days; an overall average of 34 days per proposal.
39 An estimated 550 working years of researchers’ time (95% confidence interval 513, 589) was
40 spent preparing the 3,727 proposals, which translates into annual salary costs of AUD\$66
41 million. More time spent preparing a proposal did not increase the chances of success for the
42 lead researcher (prevalence ratio (PR) of success for 10 day increase = 0.91, 95% credible
43 interval (CI) 0.78, 1.04) or other researchers (PR= 0.89, 95% CI 0.67, 1.17).

44 **Conclusions** Considerable time is spent preparing NHMRC Project Grant proposals. As
45 success rates are historically 20–25%, much of this time has no immediate benefit to either
46 the researcher or society, and there are large opportunity costs in lost research output. The
47 application process could be shortened so that only information relevant for peer review, not
48 administration, is collected. This would have little impact on the quality of peer review and
49 the time saved could be re-invested into research.

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On the time spent preparing grant proposals

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Article summary

Article focus

- Researchers would prefer to spend less time preparing grant proposals and more time on actual research.
- The time spent preparing grant proposals is thought to be large, but we do not have accurate estimates of the total time spent across Australia.

Key messages

- An estimated 550 working years of researchers' time was spent preparing proposals for Australia's major health and medical funding scheme.
- More time spent preparing a proposal did not increase the chances of success and there was no agreement between researchers' ranking of their proposals and the results from peer review.
- Most researchers understand that a perfect peer review system is not realistic.

Strengths and limitations of this study

- Our time estimates were retrospective, with no details on identifying the sections of the proposal that took the most time.
- We used a short survey to increase the response rate, but this means we have limited data on the participants and their institutions.
- Many researchers were reluctant to give us their proposal identification numbers, presumably because of confidentiality concerns.

INTRODUCTION

Project Grants are the major source of medical research funding in Australia, and were around 70% of all research funds awarded by the National Health and Medical Research Council (NHMRC) in 2012 [1]. Application numbers have steadily risen over time making the process more competitive; there were 1,881 proposals in 2003 and 3,727 in 2012, a 98% increase. For Australian researchers, this increase in proposal numbers has led to declining success rates and budget cuts for successful proposals.

Project Grants aim to support single or small teams of researchers for a defined project from one to five years. The application process takes almost a year, and has remained essentially the same for the last decade. The funding round opens in December, full proposals are submitted online in March, assessed by two external reviewers (April–May), lead researchers provide responses to the reviewers’ reports (May), grant review panels of 10–12 experts assess each proposal considering reports from two panel spokespersons and the applicants’ responses to the reviewers’ reports, and give each proposal a score (August–September). Funding is then allocated based on a ranking determined by the score until the budget is exhausted, and the successful proposals are announced (October–November). The budget for Project Grants beginning in 2013 was AUD \$458 million.

The process Australia uses, involving the assessment of full proposals, is in contrast to several comparable funding bodies overseas which use staggered application processes. For example, the UK Wellcome Trust Investigator Awards first invite a research plan; shortlisted applicants are then invited to provide more information [2]. The UK Engineering and Physical Sciences Research Council (EPSRC) have a similar staggered process for their Platform Grants [3], as do the USA National Science Foundation (NSF). The NSF’s

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97 guidelines explain that a key reason for short-listing is to reduce the wasted effort of
98 researchers spending time preparing proposals with a low chance of success [4].

99

100 Despite the importance of applying for research funding, the total time spent by researchers
101 preparing and submitting proposals is not known [5]. Guidelines on how to effectively write
102 grant proposals advise they cannot be written in a short amount of time [6], but we do not
103 know if spending more time increases the chance of success. A Nobel Laureate in Physics,
104 and Australian-based researcher, Professor Brian Schmidt recently highlighted the large
105 amount of time Australian researchers were wasting on preparing lengthy proposals for
106 Australian Research Council funding [7].

107

108 We surveyed the Australian medical research community in order to estimate their time spent
109 preparing proposals and whether spending more time increased their chance of success. We
110 also examined whether previous experience with peer review improved their success.

111

112 **METHODS**

113 *Study design*

114 In March 2012, Australian researchers working in health and medicine submitted 3,727
115 proposals to the NHMRC Project Grant funding scheme [8]. We attempted to contact the lead
116 researchers of every proposal by contacting the offices of research of every Australian
117 university and research institute. Of the 51 offices approached, 30 (59%) agreed to distribute
118 an e-mail invitation to their researchers. There was no reminder e-mail. Willing researchers
119 completed a short online survey from March to May 2012. The funding outcomes were
120 announced by the NHMRC in October 2012. This study was approved by the Queensland
121 University of Technology Ethics Committee (approval number 1100001472).

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Survey questions

The online survey asked researchers to consider their time spent on proposals submitted in March 2012. For each proposal we asked them if they were the lead researcher and how much time they spent (in days), and whether the proposal was new or a resubmission. We also asked them about their previous experience with the peer review system as a reviewer and expert panel member, which are roughly akin to being a peer reviewer for a journal and part of the editorial board. We asked for their salary in order to estimate the financial costs of preparing proposals. To protect the anonymity of our participants, and to minimise their time spent completing the survey, we did not ask them for extra personal details or for the name of their institution.

For researchers who submitted two or more proposals we asked them to rank their proposals in order of which most deserved funding. Researchers also responded to a hypothetical scenario concerning their desired level of reliability between two independent peer review panels (Box 1). This was used to estimate the desired reliability of the peer review process. The hypothetical numbers of 100 proposals and 20 funded were based on a realistic NHMRC Project Grant panel.

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Box 1: Hypothetical scenario on peer review reliability

Question: Imagine that 100 Project Grant proposals in the same field have been reviewed by a panel of 10 experts. They selected 20 proposals for funding.

Now imagine that a second panel of 10 experts reviews the same 100 proposals and must independently decide on which 20 proposals deserve funding. How many of the 20 proposals originally selected for funding would you want to also be selected by the second panel?

Response options: Exactly the same 20 proposals, a difference of 1 proposal, [...], 20 completely different proposals.

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Statistical methods

The total number of days spent preparing proposals was estimated using the following equation:

$$3727 \times \{(1 - P) \times [T(N,L) + (M - 1) \times T(N,O)] + P \times [T(R,L) + (M - 1) \times T(R,O)]\}$$

where 3,727 is the total number of proposals in 2012, P is the proportion of resubmitted proposals, T() is the average time spent in days for a combination of new or resubmitted (N or R) proposals, lead or other researchers (L or O), and M is the average number of researchers per proposal. This equation recognises that resubmitted proposals usually take less time than new proposals, and that lead researchers generally spend more time than the other researchers. This estimate on the scale of working days was scaled to working years by assuming 46 working weeks per year. A bootstrap 95% confidence interval was calculated by randomly re-sampling from the observed responses to capture the uncertainty in the time spent, number of researchers and proportion of resubmissions [9]. Of the 3,727 proposals submitted, 18 were subsequently withdrawn [8]. These withdrawn proposals were included in

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158 our estimate of the total time, as this time is still valid for our aim of capturing the total
159 researcher time spent preparing proposals across Australia.
160
161 We used logistic regression to estimate the prevalence ratio of success according to
162 researcher experience and time spent on the proposal. Prevalence ratios are the ratio of two
163 probabilities, whereas odds ratios are the ratio of two odds [10]. Using prevalence ratios
164 allows us to make multiplicative statements about probabilities (e.g., twice as likely) that are
165 not possible with odds ratios.
166
167 There were small amounts of missing data (0–7%) for the questions on researcher experience
168 and times. These missing data were imputed using multiple imputation based on the observed
169 responses. For example, 35% said they had previously served on a peer review panel, hence
170 missing values to this question were randomly imputed as “Yes” with probability 0.35.
171 The imputation and logistic regression model were performed simultaneously using a
172 Bayesian model, hence the final estimates of the prevalence ratios for success incorporate the
173 uncertainty due to missing data. The model was fitted using the Bayesian WinBUGS software
174 [11] and the prevalence ratios are presented as means with 95% credible intervals (CIs).
175
176 We examined potential non-linear associations between time spent and success. These were:
177 a threshold beyond which more time did not increase the probability of success, log-
178 transformed time and a quadratic association; but found no statistically significant
179 associations (results not shown).
180
181 We compared the researchers’ ranking of their proposals with their success or failure in the
182 peer review system. For each pair of proposals from the same researcher we compared their

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183 relative low and high ranking with their funding success (yes or no). We only examined those
184 proposals where there was a difference in success, as pairs of grants that were both failures or
185 both successes contain no information for this analysis. We examined these results using a
186 two-by-two table, chi-squared test and Kappa agreement statistic.

187

188 RESULTS

189 Our online survey was started by 446 researchers, but only 285 (64%) provided us with their
190 proposal number(s). We needed the proposal numbers in order to match the survey responses
191 (completed from March to May 2012) with the success outcomes from the NHMRC
192 (announced in October 2012). However, many researchers were reluctant to give us this
193 information. The 285 who gave us their proposal numbers submitted 632 proposals. The
194 funding success rate in our sample was 21%, the same as the overall NHMRC success rate
195 (21%) which indicates that our sample was representative of the wider population. The
196 NHMRC received 3,727 proposals of which 3,570 were reviewed, and 731 were funded,
197 giving a success rate of 21% [8].

198

199 An estimated 550 working years of researchers' time was spent preparing the 3,727 proposals
200 (95% confidence interval: 513, 589 working years). Based on the researchers' salaries, this is
201 an estimated monetary cost of AUD\$66 million per year, which is 14% of the NHMRC's
202 total funding budget. Each new proposal took an average of 38 working days of researcher
203 time, and resubmissions took an average of 28 working days; an overall average of 34 days
204 per proposal. Lead researchers spent an average of 27 and 21 workings days per new and
205 resubmitted proposals, respectively, with the remaining time spent by other researchers.

206

207 More time spent on the proposal did not increase the probability of success (Table 1). Due to
208 concern about a lack of power to detect an association between time spent and success, we
209 used a retrospective power calculation. We had a 90% power to detect an increase in the
210 probability of success of 0.028 for a 10 day increase in time spent (based on the observed
211 times and successes of our sample). If we have missed a true association, it is likely to be
212 smaller than a 0.028 increase in probability for 10 more days of time spent.

213
214 Experience with the peer review system, as either a reviewer or expert panel member, did
215 increase the probability of success but these increases were not statistically significant
216 (Table 1). Resubmitted proposals had a statistically significant lower probability of success
217 compared with new proposals (prevalence ratio = 0.64, 95% CI: 0.43, 0.92).

218
219 There was no agreement between the researchers' rankings of their proposals and which ones
220 were funded (Table 2). The chi-squared test showed no association ($X^2 = 0.93$, p-
221 value = 0.34), and the Kappa agreement was negative (-0.06).

222
223 Researchers were willing to accept a wide range in reliability between two hypothetical peer
224 review processes (Figure 1). The modal response was a difference of 5 proposals (meaning
225 15 the same), which is a 25% disagreement in funding between the two processes.

226
227 **DISCUSSION**

228 Australian researchers spend an enormous amount of time preparing grant proposals [12]. We
229 estimate that the 2012 NHMRC Project Grant scheme cost 550 working years of researchers'
230 time, which is AUD\$66 million in terms of estimated salary costs. To put this quantum of
231 resources into perspective, it exceeds the total annual staff costs at the Walter and Eliza Hall

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232 Institute (WEHI 2012, AUD\$61.6 million), one of Australia's major medical institutes who
233 produced 284 peer-reviewed publications in 2012 [13].

234

235 As success rates for the Project Grant scheme are historically between 20% to 25%, the
236 majority of time spent preparing proposals is wasted with no immediate benefit due to the
237 failure to obtain funding. Some wasted time will be salvaged by submitting failed proposals
238 to other funding agencies or resubmitting next year. However, resubmissions took just 10
239 days less on average to prepare than new submissions, and resubmissions had a 36% lower
240 probability of success (Table 1).

241

242 Spending more time on a proposal is no predictor of success (Table 1), and the poor
243 agreement between researchers' rankings and funding success (Table 2) further demonstrate
244 how hard it is to predict success and justify spending more time on proposals. These findings
245 are consistent with previous studies on NHMRC Project Grants that have shown a high
246 degree of variation in panel members' scores [14] and a low correlation between the scores
247 assigned for track record and bibliometric measures [15].

248

249 *Underestimating time and cost*

250 Our cost estimates are likely to underestimate the true costs because some proposals are
251 started but not submitted, and we did not capture the time of researchers who provided
252 technical help or administrative staff who helped with the submission process. Also, our
253 estimates do not include the costs of peer review, which would be the time of one to three
254 external reviewers per proposal and an expert panel of 10–12 senior researchers meeting for a
255 week, as well as the administrative time of organising this peer review.

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257 Our findings are based on retrospective self-reported times spent preparing proposals, and we
258 could not verify these times. Our study was designed to minimise participant burden and
259 maximise our response rate by using a short survey that maintained anonymity. Participants
260 completed our survey soon after the NHMRC closing date for submissions which should
261 have reduced recall bias. At the time of completing the survey participants did not know if
262 their proposal had succeeded, hence our results are not biased by disgruntled researchers
263 inflating their times. Future research could use diaries to prospectively collect the time spent
264 preparing proposals and identify the sections of the proposal that took the most time. Future
265 research could also examine whether preparing unsuccessful proposals provides any benefits
266 to the researchers in terms of refining their scientific ideas.

267
268 *Excessive information*

269 Researchers would prefer to spend less time writing proposals and more time on actual
270 research [16]. Our results show that most researchers do not expect a perfect system
271 (Figure 1). Hence the amount of information collected does not need to aim for the “ideal”
272 system shown in Figure 2. Most researchers understand that a perfect system is unachievable.
273 The hypothetical association between the information that the system collects (which
274 determines the time spent by researchers) and the accuracy of the system is plotted in
275 Figure 2. Underlying the figure is the notion that the marginal cost of providing more
276 information is rising (which is consistent with our results regarding time spent on grant
277 preparation and success) and the marginal benefit flowing from this information in improving
278 the ranking of proposals is declining [17]. The standard way of optimising the amount of
279 information collected is to equate the marginal benefits with the marginal costs – which occur
280 at the maximum net benefit. Beyond this point, marginal costs to the applicant outweigh the
281 benefits even though there may still be improvements in accuracy of ranking. One may also

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reach a point where the net benefits become negative, when additional information only
confuses the ranking process.

Our results suggest that the current NHMRC Project Grant system collects more information
than is necessary as the association between time spent (at an individual level) and success
was negative (Table 1), putting it on the downward slope of Figure 2. Project Grant proposals
are between 80 and 120 pages long, and panel members are expected to read and rank
between 50 to 100 proposals. It is optimistic to expect accurate judgements in this sea of
excessive information. An alternative application process is to use an initial short proposal
with successful proposals being asked to provide more information that would then be used to
determine funding.

Recommendations to minimise burden

Our time estimates are comparable with two small Australian studies on time spent preparing
proposals for NHMRC Project Grants. In 2004 a sample of 69 researchers spent an average of
20 days per proposal [18]. In 2009 a sample of 42 lead researchers spent between 20 to 30
days per proposal, which, when extrapolated to the whole of Australia, gave an estimated
total preparation costs of AUD\$41 million [14]. In 2012, the Canadian Institutes of Health
Research review of their Open Operating Grant Program included a survey of 378 researchers
who spent on average 169 hours (or 23 7.5-hour working days) per proposal [19]. In Canada,
new recommended reforms include a reduction in the amount of information submitted to
minimise burden on applicants and peer reviewers [19].

A recent review of health and medical research funding in Australia recommended that the
NHMRC's online application process be simplified [20]. We agree, but also believe that the

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information requested for each proposal could be reduced. This is because the key scientific information used to judge a Project Grant’s worthiness is just nine pages of a proposal that is between 80 to 120 pages. Therefore proposals could easily be shortened without any impact on peer review. The inclusion of a staged application process starting with an expression of interest (EOI), as used in the UK and USA, would further minimise the burden on researchers. If an EOI could be used to reject 30% of proposals, and assuming that an EOI takes one-quarter of the time to prepare as a full proposal, then (based on our survey) this would save 124 years of researcher time per year. This saved time is equivalent to funding 124 new post-doctoral positions per year.

Changes to eligibility rules for resubmitting proposals from previous funding rounds could reduce the total number of applications and improve success rates. In the UK proposals submitted to the EPSRC Platform Grant scheme (2009–2010 to 2011–2012) have almost halved (3379 versus 1938) and the success rate increased (30% versus 41%) after EPSRC implemented stricter eligibility rules including a Repeatedly Unsuccessful Applicants policy [3]. From our survey, the success rate for new proposals was higher than for resubmissions therefore limitations on the resubmission of Project Grants may reduce the time wasted preparing proposals by improving the chance of success.

The format of grant proposals could be shortened so that only information relevant for peer review, not administration, is collected. The administrative data could be collected at a later date for only those proposals that were successful. Another option is to restructure the format of proposals based on the total budget, where projects with smaller budgets can submit shorter proposals. The potential savings in researcher time are enormous as preparing research proposals takes between 1 to 3 months of the year. If more of this time could be

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dedicated to actual research then there would be more and faster medical research discoveries. Weighing down researchers in a lengthy grant proposal process is a poor use of valuable researcher time.

335

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341

342 REFERENCES

- 343 1. National Health and Medical Research Council. Funding Rate and Funding by
344 Funding Scheme. Canberra: NHMRC, 19 Oct 2012.
345 <http://www.nhmrc.gov.au/grants/outcomes-funding-rounds> (accessed Nov 2012).
- 346 2. Wilkinson E. Wellcome Trust to fund people not projects. *Lancet* 2010; 375: 185-186.
- 347 3. Engineering and Physical Sciences Research Council. Research Proposal Funding
348 Rates 2011-2012. Swindon: EPSRC, 2012.
349 <http://www.epsrc.ac.uk/SiteCollectionDocuments/funding/FundingRates1112.pdf>
350 (accessed Jan 2013).
- 351 4. National Science Foundation. Grant proposal guide. Arlington VA: NSF, 2011. p I-3.
352 <http://www.nsf.gov/pubs/policydocs/pappguide/nsf11001/gpgprint.pdf> (accessed Nov
353 2012).
- 354 5. Wood FQ, Meek VL, Harman G. The research grant application process. Learning
355 from failure? *Higher Education* 1992; 24: 1-23.
- 356 6. Kreeger K. A winning proposal. *Nature* 2003; 423: 102-103.

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41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
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357 7. Schmidt B. We must rebuild our grants system. *The Australian*. 2012 Nov 14.
358 Section: Opinion.
359 [http://www.theaustralian.com.au/higher-education/opinion/we-must-rebuild-our-](http://www.theaustralian.com.au/higher-education/opinion/we-must-rebuild-our-grants-system/story-e6frgcko-1226516110682)
360 [grants-system/story-e6frgcko-1226516110682](http://www.theaustralian.com.au/higher-education/opinion/we-must-rebuild-our-grants-system/story-e6frgcko-1226516110682) (accessed Nov 2012).
361 8. National Health and Medical Research Council. Project Grants for funding
362 commencing in 2013. Canberra: NHMRC, 19 Oct 2012.
363 [https://www.nhmrc.gov.au/_files_nhmrc/file/grants/funding/funded/2012/project_gra](https://www.nhmrc.gov.au/_files_nhmrc/file/grants/funding/funded/2012/project_grants_funding%20commencing_2013_121018_1.docx)
364 [nts_funding%20commencing_2013_121018_1.docx](https://www.nhmrc.gov.au/_files_nhmrc/file/grants/funding/funded/2012/project_grants_funding%20commencing_2013_121018_1.docx) (accessed Nov 2012).
365 9. Davison AC, Hinkley DV. Bootstrap methods and their application. Cambridge:
366 Cambridge University Press, 1997.
367 10. Deddens JA, Petersen MR. Approaches for estimating prevalence ratios. *Occup*
368 *Environ Med* 2008; 65: 501-506.
369 11. Lunn DJ, Thomas A, Best N, Spiegelhalter, D. WinBUGS - A Bayesian modelling
370 framework: concepts, structure, and extensibility. *Stat Comput* 2000; 10: 325-337.
371 12. Herbert DL, Barnett AG, Graves N. Funding: Australia's grant system wastes time.
372 *Nature* 2013; 495 (7441): 314.
373 13. Walter and Eliza Hall Institute of Medical Research. Annual Report 2011-2012.
374 Melbourne: WEHI, 2012. p168.
375 http://www.wehi.edu.au/uploads/11-12_WEHI_Annual_Report.pdf (accessed Feb
376 2013).
377 14. Graves N, Barnett AG, Clarke P. Funding grant proposals for scientific research:
378 retrospective analysis of scores by members of grant review panel. *BMJ* 2011; 343:
379 d4797.

On the time spent preparing grant proposals

17

- 1
2
3 380 15. Nicol MB, Henadeera K, Butler L. NHMRC grant applications: a comparison of
4
5 381 “track record” scores allocated by grant assessors with bibliometric analysis of
6
7 382 publications. *Med J Aust* 2007; 187: 348-352.
8
9
10 383 16. Smith R. Classical peer review: an empty gun. *Breast Cancer Res* 2010; 12 Suppl 4:
11
12 384 S13.
13
14 385 17. Thomas CR, Maurice SC. Managerial Economics. 9th edition. Boston: McGraw-Hill
15
16 386 Irwin, 2008.
17
18 387 18. Mow KE. Inside the black box: research grant funding and peer review in Australian
19
20 388 research councils. LAP Lambert Academic Publishing. 2010. p188-191
21
22
23 389 19. Canadian Institutes of Health Research. Evaluation of the Open Operating Grant
24
25 390 Program: final report. Ontario:CIHR, 2012. [http://www.cihr-](http://www.cihr-irsc.gc.ca/e/documents/oogp_evaluation_report_2012_e.pdf)
26
27 391 [irsc.gc.ca/e/documents/oogp_evaluation_report_2012_e.pdf](http://www.cihr-irsc.gc.ca/e/documents/oogp_evaluation_report_2012_e.pdf) (accessed Feb 2013)
28
29
30 392 20. Commonwealth of Australia. Strategic Review of Health and Medical Research in
31
32 393 Australia – better health through research. Canberra: DOHA, 2013.
33
34 394 [http://www.mckeenreview.org.au/downloads/Strategic_Review_of_Health_and_Medi](http://www.mckeenreview.org.au/downloads/Strategic_Review_of_Health_and_Medical_Research_Feb_2013-Final_Report.pdf)
35
36 395 [cal_Research_Feb_2013-Final_Report.pdf](http://www.mckeenreview.org.au/downloads/Strategic_Review_of_Health_and_Medical_Research_Feb_2013-Final_Report.pdf) (accessed Apr 2013)
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397 Table 1 Prevalence ratios of funding success by researcher experience and time spent on
398 proposal

Researcher's experience and time	PR	95% CI
Ever served on peer review panel (Yes vs No)	1.27	0.89, 1.74
Ever peer reviewed a proposal (Yes vs No)	1.33	0.78, 2.22
Salary (per \$5000 increase)	0.99	0.94, 1.04
Resubmitted proposal (Yes vs No)	0.64	0.43, 0.92
Time for lead researchers (10 day increase)	0.91	0.78, 1.04
Time for other researchers (10 day increase)	0.89	0.67, 1.17

399 PR = prevalence ratio, CI = credible interval

400
401
402 Table 2 Agreement between researchers' relative ranking of their proposals and funding
403 success.

Researcher's ranking	Funding success	
	No	Yes
Low	82	92
High	92	82
Kappa agreement	-0.06	

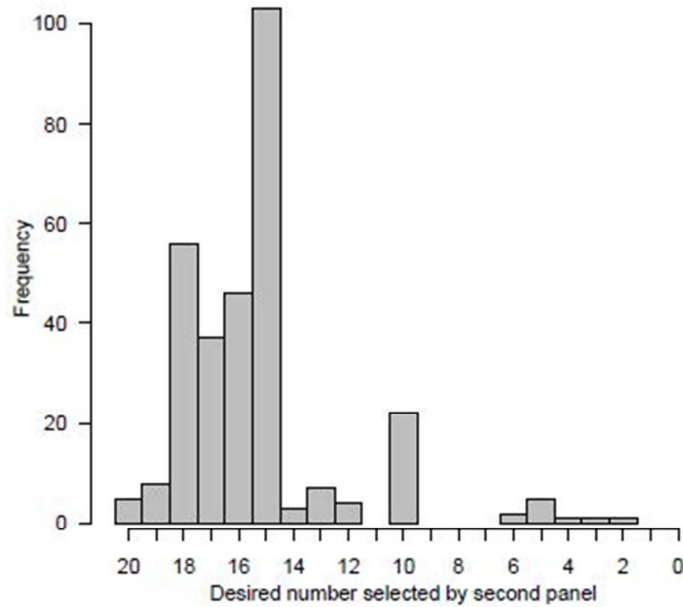


Figure 1: Desired reliability of a hypothetical system (see Box 1 for hypothetical question)

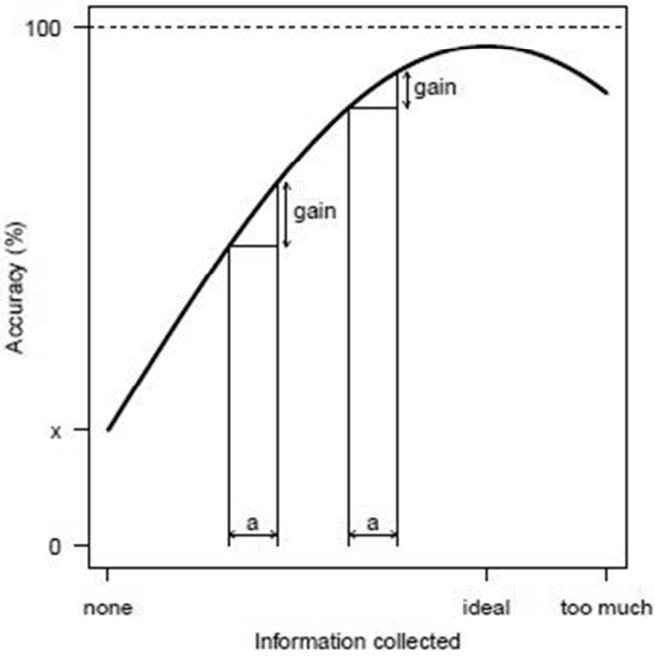


Figure 2: Hypothetical association between the information collected for peer review and the accuracy of awarding the best proposals. To draw this association we assume that all proposals can be ranked (without ties) from the best to the worst.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1,2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4,5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5,6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5,6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5,6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7-9
		(b) Describe any methods used to examine subgroups and interactions	8,9
		(c) Explain how missing data were addressed	8
		(d) If applicable, describe analytical methods taking account of sampling strategy	7-9
		(e) Describe any sensitivity analyses	8,9
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	9
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	8
Outcome data	15*	Report numbers of outcome events or summary measures	9
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10, Tables 1-2, Figure 1
		(b) Report category boundaries when continuous variables were categorized	n/a
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	8, Table 1
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	10, Tables 1-2, Figure 1
Discussion			
Key results	18	Summarise key results with reference to study objectives	10,11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11,12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	13-15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

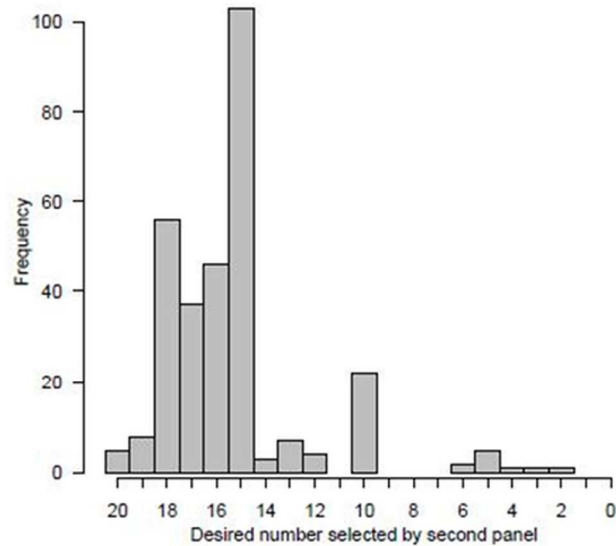


Figure 1: Desired reliability of a hypothetical system (see Box 1 for hypothetical question)

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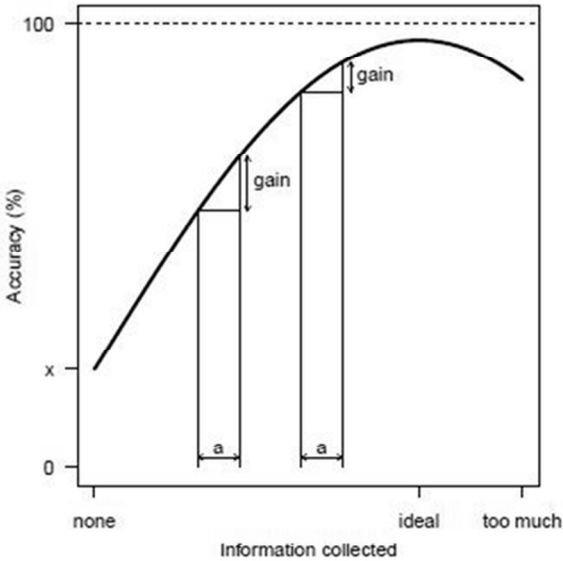


Figure 2: Hypothetical association between the information collected for peer review and the accuracy of awarding the best proposals. To draw this association we assume that all proposals can be ranked (without ties) from the best to the worst.

102x90mm (300 x 300 DPI)